A PRELIMINARY SURVEY OF THE ALGAE OF

THE EDMONTON REGION OF ALBERTA

by

JOHN RUSSEL CAREFOOT

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THE UNIVERSITY OF ALBERTA

A PRELIMINARY SURVEY OF THE ALGAE OF THE EDMONTON REGION OF ALBERTA

A DISSERTATION

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES

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by

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SYNOPSIS

This survey had two purposes. The first was to provide an annotated check list of species of the algae of Alberta and the second was to study variation in populations of algae according to season and habitat.

A detailed study of Astotin Lake and Muir Lake revealed the following factors to be primary causes of the vastly different algal floras of the two lakes: size and depth; local topography and its effect on the water economy; the nature of the substratum as related to its geological origin. Phosphate, pH and alkalinity were found to have some governing effect upon the species present, but the role of organic matter in the environments could only be speculated upon.

A distinct type of algal community was found on the stems and leaves of plants in grassy sloughs which are produced by spring run-off.

The nature of the community of endophytes inhabiting the mucilage of some colonial blue-green algae was studied and several interesting features were noted.

The annotated check list contains information on the nature of the immediate environment and seasonal and geographical distribution of about two hundred ninety

species of algae.

As this survey was preliminary and therefore of a limited scope, the discussions of ecology are based upon only a small amount of information obtained over a period of a little more than one year.

Although the list of species in incomplete, it represents species from many of the various habitats in which algae are to be found and constitutes a preview, at least, of what is to be found. In order to obtain a more complete list some previous records of Alberta algae from the work of Lewis and Dowding [3] are included in a separate section.

Most of the collections are from the Edmonton region, within a radius of forty miles. There are a number of collections from outlying districts, ranging from the Peace River region in the north, Cold Lake in the east, Kananaskis Lake in the south and Moose Lake (near Edson) in the west.

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PART I

A COMPARISON OF THE ALGAL FLORAS OF TWO ALBERTA LAKES

Nature and Purpose of the Survey

In this survey the algal flora of two Alberta lakes, Astotin and Muir, has been studied intensively. The study covers a period of one complete summer season, from the time the ice began to melt in the spring to when the ice covered the lakes in the fall.

The choice of these two lakes was based on their geographical and geological location, their water economy and their size and depth. The purpose of this study was to determine whether or not there is any relationship between geological origin of these lakes and their algal flora.

Location and Probable Origin of the Lakes

Both are "kettle lakes" formed by water accumulated in basins left by the melting of huge ice blocks isolated after the recession of Pleistocene glaciers.

Astotin Lake is situated in Elk Island National Park, about thirty-five miles east of Edmonton on

Highway 16 (Section 23, Township 54, Range 20, west of the fourth meridian). The basin of this lake was probably formed by the melting of several confluent ice blocks, as the numerous islands in it suggest. Elk Island Park is situated on the Beaverhill moraine. Since the glacier which formed this moraine advanced from the Canadian Shield, much of the debris may contain material of granitic origin.

Muir Lake is situated five miles north and two miles west of the Town of Spruce Grove. The legal location is: Northwest quarter of Section 31, Township 53, Range 27, west of the fourth meridian. It was probably formed by the melting of a single ice block in the terminal moraine of glaciers originating in the east slope of the Rocky Mountains. For this reason it is assumed that the morainic debris contains material of sedimentary origin, eg. limestone, shale, etc.

Water Economy and its Effect on Dissolved Substances

The water economy of a lake may be defined as the influx and loss of its water.

The main source of water for Astotin Lake is surface drainage from the surrounding terrain. The sole drainage is through a single small creek which runs for only a few days in the spring, if the previous winter precipitation has been large. Other water loss

may be attributed to evaporation and seepage. The relatively high concentration of solutes in this lake (see Table I.) is attributed to the nature of the water economy. Surface water running into the lake contains much dissolved and suspended matter. Because of the negligible drainage, these substances must be concentrated by evaporation of the water. Because of the high organic matter content (see Table I., ignition loss) the amount of inorganic salts available to plants is probably less than is reported in the analysis. This may be caused by the binding of minerals in organic molecules (chelation). The water economy of the lake and the nature of the adjacent soils are factors determining the type and amount of minerals present.

The two main sources of water for Muir Lake are surface drainage and springs entering from the bottom of the lake. The general topography of the vicinity is hilly, with numerous small creeks. The water-shed for this lake is small, only a few square miles, as much of the precipitation in the surrounding area eventually escapes in many other small drainage systems. That springs play an important part in the water economy is evidenced by the fact that ice formation is delayed for almost three weeks in two places in the lake. Presumably the influx of water above the freezing point

causes this. Further evidence supporting the idea that underwater springs are present is the abundance of very large gravel hills or kames around the lake. A sloping impervious substratum beneath these gravel hills could easily be the cause of contact springs entering below the level of the lake.

Drainage of Muir Lake is into a series of smaller ponds and thence into a small creek.

The apparently continual renewal of the water in Muir Lake, as suggested above, leads to the conclusion that its mineral content should be rather low in comparison with that of Astotin Lake. This is substantiated by chemical analysis (see Table I.).

Table I. Chemical Analysis of Astotin and Muir Lake Water. 1/

Substances present	Parts per Million	
	Astotin L. 14-7-58	Muir L. 28-7-58
Total solids.....	304	174
Ignition loss.....	146	98
Hardness.....	185	115
Sulfates.....	24	nil
Chlorides.....	4	nil
Nitrites.....	nil	nil
Nitrates.....	nil	nil
Iron.....	2.5	0.6
Phosphates.....	0.55	0.01
Alkalinity.....	190	135
Nature of alkalinity....	Bicarbonate of Soda, Lime & Magnesium	Bicarbonate of Soda, Lime & Magnesium
pH.....	9.2	8.2

1/ pH and phosphate (as orthophosphate) determined by writer, other determinations by the Provincial Analyst, University of Alberta.

Size, Depth and Non-algal Floras of the Lakes

Astotin Lake has an area of approximately four hundred acres and its maximum depth does not exceed two hundred feet. Numerous shallow bays and areas around some of the islands are choked with rooted aquatic plants, such as Myriophyllum sp. and Potamogeton sp. in mid-summer, suggesting that the maximum depth of these areas, which cover about one eighth of the lake, is not more than fifteen feet. In these shallow areas the bottom is covered with several feet of soft black mud consisting largely of semi-decomposed plant matter.

The margin of Astotin Lake is quite marshy, with the exception of several sandy beaches on windward shores, and maintains such plants as Juncus sp., Typha sp., Equisetum sp. and coarse grasses.

Muir Lake has an area of about eighty acres, most of which is not over fifteen feet deep. The marginal vegetation is predominantly Equisetum sp., with other plants such as Sagittaria sp., Ranunculus sp. (both aquatic and terrestrial), Typha sp. and

coarse grasses. Shallow sandy beds of the lake are also characterized by Equisetum sp., here in association with vast"meadows" of Chara sp. a macroscopic alga. Shallow areas with silty or muddy bottoms are also characterized by Nuphar variegatum Engelm. and an aquatic species of Ranunculus.

A Comparison of the Species in Astotin Lake and Muir Lake

Astotin lake is more productive in terms of net amount per unit volume (eg.as weight) of algal vegetation produced per season than is Muir Lake. No exact information has been obtained, but this conclusion seems justified by the fact that Astotin Lake is subject to intense blooms during much of the summer. In contrast, blooms have never been observed on Muir Lake.

Of the two lakes, Astotin Lake has many more species. In this survey, Astotin Lake has been found to have ninety-seven species (excluding diatoms) whereas Muir Lake (excluding diatoms) has only forty-nine species, with only fifteen species common to both. The difference must be due to unique environmental factors.

Table II below includes the species common to both lakes and indicates their range of occurrence in time as observed.

Table II. Species Common to Muir and Astotin Lake

Species	Period of Occurrence	
	Muir Lake	Astotin Lake
Pandorina morum (Muell) Bory	Enrichment cult.	June 26
Gloeocystis major Gerneck ex Lemm..	July 5-Oct. 8	Enrichment cult.
Pediastrum boryanum (Turp.) Menegh..	July 5-23	April 27-July 27
Coelastrum microporum Naegeli	July 5-Aug. 1	July 12
Ankistrodesmus falcatus (Corda) Ralfs	Enrichment cult.	April 19
Oocystis borgei Snow	July 23-Aug. 1	July 12-27
Scenedesmus quadricauda var. quadrispina (Chod.) G.M. Smith .	May 9- July 5	April 27- July 12
S. quadricauda var. westii G.M. Smith	July 5	April 27- July 12
Ceratium hirundinella (O.F. Muell.) Dujardin	July 5- Aug. 1	June 26
Mallomonas sp.	Enrichment cult.	April 19- July 22
Asterionella formosa Hass.	July 5- Aug. 1	June 26
Microcystis aeruginosa Kuetz., emend Elenkin	July 5	June 26- Sept. 21
Oscillatoria tenuis C.A. Agardh ..	May 9	May 22
Anabaena flos-aquae (Lyngb.) De Breb	July 5-23	June 2- July 27
A. spiroides var. crassa Lemm. ...	July 23- Aug. 1	June 2- July 27

Table III (below) lists all the species of algae found in Astotin Lake. The references used for the identification of species are: 6/, 7/, 9/, 11/, 12/, 13/, 14/ and 15/. Those preceded by the symbol # are species common to both lakes.

Table III. Astotin Lake.-- Check list of species.

Characeae

none

Chlorophyceae

Chlamydomonas globosa Snow

Eudorina elegans Ehrenberg

Gonium pectorale Mueller

Pandorina morum (Muell.) Bory

Gloelcystis major Gerneck ex Lemmermann

Palmella mucosa Kuetzing

Sphaerocystis schroeteri Chodat

Hormidium sp.

Ulothrix subtilissima Rabenhorst

Uronema sp.

Microspora willeana Lagerheim

Chaetopeltis sp.

Stigeoclonium nanum Kuetzing

Protococcus viridis ? C.A. Agardh

Coleochaete sp.

Chaetomorpha linum (Muell.) Kuetzing

Cladophora sp.

Cladophora fracta (Dillw.) Kuetzing

Rhizoclonium fontanum Kuetzing
possibly Chaetomorpha linum (Muell.) Kuetz.

Oedogonium aereoliferum (Jao) Tiffany

Characium gracilipes Lambert

Characium obtusum A. Braun

Pediastrum boryanum (Turp.) Meneghini

Pediastrum boryanum var. undulatum Wille

Pediastrum duplex Meyen

Pediastrum duplex var. cohaerens Bohlin

Pediastrum duplex var. gracilimum West and West

Pediastrum duplex var. reticulatum Lagerheim

Pediastrum sculptatum G.M. Smith

Coelastrum microporum Naegeli

Ankistrodesmus falcatus (Corda) Ralfs

Ankistrodesmus falcatus var. acicularis
(A.Braun) G.S. West

Cerasterias staurastroides West and West

Dictyosphaerium ehrenbergianum Naegeli

Dictyosphaerium pulchellum Wood

Oocystis borgei Snow

Oocystis parva West and West

Scenedesmus sp.

Scenedesmus abundans var. brevicauda G.M. Smith

Scenedesmus arcuatus var. platydisca G.M. Smith

Scenedesmus bijuga (Turp.) Lagerheim

Scenedesmus dimorphus Kuetzing

Scenedesmus obliquus (Turp.) Kuetzing

Scenedesmus opoliensis var. contacta Prescott

Scenedesmus quadricauda (Turp.) de Brebisson

Scenedesmus quadricauda var. parvus G.M. Smith

Scenedesmus quadricauda var. quadrispina (Chod.) G.M. Smith

Scenedesmus quadricauda var. westii G.M. Smith

Tetradesmus sp.

Spirogyra spp. (5)

Spirogyra reflexa Transeau

Closterium venus Kuetzing

Closterium peracerosum var. elegans G.S. West

Cosmarium obtusatum Schmidle

Phymatodocis sp.

Staurastrum sp.

Euglenophyta

Euglena minuta Prescott

Trachelomonas abrupta (Swir.) Deflandre

Pyrrophyta

Ceratium hirundinella (O.F. Muell.) Dujardin

Chrysophyta

Characiopsis acuta (A.Braun) Borzi

Mischococcus confervicola Naegeli

Mallomonas sp.

Asterionella formosa Hass.

Melosira granulata (Ehr.) Ralfs

Stephanodiscus (niagarae ?) Ehrenberg

Cyanophyta

Aphanothece castagnei (de Breb.) Rabenhorst

Chroococcus limneticus Lemmermann

Microcystis aeruginosa Kuetx. emend Elenkin

Chamaesiphon sp.

Arthrospira gomontiana Setchell

Oscillatoria acutissima Kufferath

Oscillatoria sp.

Oscillatoria amphibia Agardh

Oscillatoria angusta Koppe

Oscillatoria angustissima West and West

Oscillatoria limnetica Lemmermann

Oscillatoria splendida Greville

Oscillatoria subbrevis Schmidle

Oscillatoria tenuis C.A. Agardh

Spirulina major Kuetzing

Spirulina sp.

Anabaena aequalis Borge

Anabaena affinis Lemmermann

Anabaena flos-aquae (Lyngb.) de Brebisson

Anabaena spiroides var. crassa Lemmermann

Aphanizomenon flos-aquae (L.) Ralfs

Gloeotrichia echinulata (J.E. Smith) P. Richter

Table IV. Muir Lake.-- Check list of species.

Characeae

Chara sp.

Chlorophyceae

Chlamydomonas pseudopertyi Pascher

#Pandorina morum (Muell.) Bory

Volvox globator L.

#Gloeocystis major Gerneck

Ulothrix aequalis Kuetzing

Coleochaete soluta (de Breb.) Pringsheim

Oedogonium angustissimum West and West

#Pediastrum boryanum (Turp.) Meneghini

Pediastrum duplex var. reticulatum Lagerheim

Pediastrum tetras (Ehrenb.) Ralfs

#Coelastrum microporum Naegeli

#Ankistrodesmus falcatus (Corda) Ralfs

#Oocystis borgei Snow

Planktosphaeria gelatinosa G.M. Smith

Selenastrum westii G.M. Smith

Tetraedon trigonum var. gracile (Reinsch) DeToni

Scenedesmus incrassatulus Bohlin

#Scenedesmus quadricauda var. quadrispina (Chod.) G.M. Smith

#Scenedesmus quadricauda var. westii G.M. Smith

Mougeotia spp. (2)

Spirogyra spp. (3)

Zygnema sp.

Cosmarium pachydermum Lund.

Staurastrum sp.

Staurastrum granulosum fa. connexa (Ehrenb.) Ralfs

Staurastrum paradoxum Meyen

Euglenophyta

Phacus curvicauda Swirenko

Pyrrophyta

Peridinium cinctum (Muell.) Ehrenberg

#Ceratium hirundinella (O.F. Muell) Dujardin

Chrysophyta -sub division Chrysophyceae

#Mallomonas sp.

Stipittoccus capense Prescott

Synura uvella Ehrenberg

Dinobryon sertularia Ehrenberg

-sub division Bacillariophyceae

#Asterionella formosa Hass.

Tabellaria flocculosa (Roth) Kuetzing

Cyanophyta

Aphanocapsa pulchra (Kuetz.) Rabenhorst

Chroococcus dispersus (Keissl.) Lemmermann

Chroococcus turgidus (Kuetz.) Naegeli

#Microcystis aeruginosa Kuetz. emend Elenkin

Coelosphaerium sp.

Lyngbya aestuarii (Mert.) Liebmann

Oscillatoria limosa (Roth) C.A. Agardh

#Oscillatoria tenuis C.A. Agardh

Spirulina princeps (West and West) G.S. West

#Anabaena flos-aquae (Lyngb.) de Brebisson

Anabaena planctonica Brunnthaler

Anabaena scheremetievi Elenkin

#Anabaena spiroides var. crassa Lemmermann

Nostoc verrucosum Vaucher

Relationships Between Algal Flora and Dissolved Substances

As previously shown, the algal floras and the relative proportions of dissolved substances in Astotin Lake and Muir Lake differ greatly. In order to determine the relationship between algal flora and the nature of the dissolved substances, it is necessary to introduce information from observations of other lakes studied in this survey.

Table V (below) is designed to shed some light on this problem. The list of lakes has been arranged in a definite order for purposes of clarity. Determinations of pH and phosphate were carried out. Measurements of pH were made in the field with a portable electric meter. Phosphate determinations were carried out colorimetrically according to standard methods [10] and represent orthophosphate. The lower limit of this determination is 0.01 parts per million and determinations so recorded may be lower.

Half Moon lake has an intense bloom all summer. This bloom is almost entirely Myxophycean in nature with only a very small proportion of diatoms and euglenids. Astotin Lake, though possessing a minority of species of Myxophyceae, has, in terms of relative bulk, a much greater proportion of blue-green algae.

Table V. Chemical Characteristics of Some Alberta Lakes

Lake	pH	Parts per million of PO_4	Alkalinity	
Half Moon	9.0	0.61	175	Bicarbonate of Ca, Mg, Na.
Astotin	9.2	0.55	190	Bicarbonate of Ca, Mg, Na.
Cooking	9.1	0.09	---	----------
Edmonton Beach	8.9	0.01	---	----------
Eden	8.2	0.01	---	----------
Muir	8.2	0.01	135	Bicarbonate of Ca, Mg, Na.
Allan	8.3	0.01	---	----------
Chikakoo	8.3	0.01	90	Bicarbonate of Ca, Mg.

Cooking Lake also exhibits a bloom throughout the summer, which, although not as intense as in Half Moon Lake or Astotin Lake, gives the water a distinct pea-green color. This is caused by plankton consisting of about half Myxophyceae and the rest of other types of algae. Edmonton Beach Lake exhibits a bloom similar to that in Cooking Lake, but it is not so constant through the summer, showing at intervals rapid formation of blooms which are predominantly Myxophycean.

Allan Lake, Chikakoo Lake and Lake Eden are similar to Muir Lake in respect to blooms. Like Muir Lake they have never been known to bloom.

From Table V, it can be seen that blooms occur in lakes which have a relatively high pH. Furthermore, it seems that a predominance of Myxophyceae is associated with an higher orthophosphate concentration (above 0.5 parts per million) and an higher alkalinity in terms of calcium, magnesium and sodium bicarbonate (above 170 parts per million). The higher pH in lakes having blooms is a result of dense algal populations. Assimilation of carbon dioxide from the water by the photosynthetic activity of the algae allows soluble carbonates to replace the carbon dioxide. This causes the pH to increase.

Gerloff et al[2/], in their study of the mineral nutrition of Microcystis aeruginosa Kuetz., emend

Elenkin, a species common in water blooms in Astotin Lake, found optimum growth at pH 10, with very little growth at pH 8 and below. Thus, the first increase in pH probably provides a near optimum pH for the growth of Microcystis aeruginosa Kuetz. Emend Elenkin to bloom proportions. As previously indicated, Muir Lake does not bloom and has a pH of 8.2, whereas Astotin Lake has an almost continuous bloom and a pH of 9.2 .

On the other hand, phosphate concentration has been shown to exert a selecting influence on populations of algae. Chu[1] indicates that the upper limits of phosphorus for optimum phytoplankton growth is higher than that occurring in natural waters, and that low phosphorus concentrations may limit the growth of certain algae, thereby exerting a selective influence on plankton populations. Astotin Lake, with a rich flora, has a phosphate concentration of 0.55 parts per million, whereas Muir Lake has less than 0.01 parts per million of phosphate. Though this is obviously not the only factor involved, comparative phosphate concentrations may explain why there are fewer algal species in Muir Lake.

The role that dissolved organic material plays in the algal population is, though very important, not too well known in specific terms. Saunders[8] sums up the ways in which organic matter exerts its effect on organisms.

It may supply or withhold minerals or metabolic substrates, or it may supply growth stimulants or suppressors.

The relations between dissolved organic matter and the flora of Astotin Lake and Muir Lake have not been studied by the writer, but it is felt that this aspect is very important.

Astotin Lake, which is a resort lake, has been treated with an algicide, copper sulfate. The treatment consisted of the application of 8500 pounds of the chemical in 800-1000 pound portions at intervals during June, July and August. There is no doubt that this treatment has some effect on the flora. This effect was not so much the reduction in quantity of the algae as the change in proportions of species. Since the alkalinity of the lake is high, it is possible that the copper sulfate was precipitated as insoluble carbonates and hydroxides, leaving only a small trace of the salt dissolved. According to Palmer and Tarzwell[5], Ankistrodesmus, Pediastrum and Scenedesmus are stimulated to multiply by copper sulfate concentrations of 0.5 parts per million. Higher proportions of these genera developed within a short time after each application.

PART II

THE "GRASSY SLOUGH" COMMUNITY

The examination of algae from undisturbed grassy sloughs in three widely separated areas reveals an unique type of algal community.

The sloughs are temporary, filling in the spring from surface run-off and drying in June, after which coarse grasses dominate the depression. The soil underlying these sloughs is a rich loam with a considerable amount of dead, but only slightly decayed vegetation on the surface. Water temperature in these sloughs ranges from just above freezing to about twenty-one degrees centigrade in late spring.

The algal community consists of a slimy mass of filamentous green algae, with epiphytes and a a number of free-living forms, some restricted to the masses and some free-living in the external aqueous environment.

The species which are distinctive are Ophiocytum spp. and Derepyxis amphora Stokes. These were found in abundance in this environment, but were not found in any other environment covered by this survey. Grassy sloughs in disturbed areas such as cow pastures were similar, having filamentous green algae like Ulothrix , but lacking species of Ophiocytum. Instead, species

belonging to the Volvocales, such as Chlamydomonas, Gonium, and Eudorina dominated. A species which is regarded as having an indicator value suggesting ah high nitrogen content, Spondylomorum quaternarium Ehrenberg was found in these pasture sloughs. From this it seems that in essentially the same habitats, the higher nitrogen content from manure prevents the growth of Ophiocytium.

Table VI (below) indicates the distribution of species in the three grassy sloughs examined.

Table VI.

Distribution of Species in the "Grassy Slough" Environment

Species	Elk Island Park	Edmonton, below campus	East of Muir Lake
Eudorina elegans Ehrenberg	x	---	---
Sphaerocystis schroeteri Chodat	x	---	---
Ulothrix subconstricta G.S. West ...	x	---	---
Microspora stagnorum (Kuetz.) Lag. ..	---	x	x
Characium debaryanum (Reinsch) DeToni.	---	x	---
C. gracilipes Lambert	x	---	---
Euglena oxyuris var. minor Prescott .	x	---	---
E. sanguinea Ehrenberg	x	---	---
Trachelomonas pulcherrima Playfair ..	x	---	---
T. superba var. spinosa Prescott ...	x	---	---
Characiopsis pyriformis (A.Braun) Borzi	x	---	---
Ophiocytum cochleare (Eichw.) A.Braun	x	---	---
O. desertum Printz	---	x	---
O. desertum var. minor Prescott	x	x	x

Ophiocytium gracilipes Rabenhorst	x	---	---
O. parvulum (Perty) A. Braun	x	x	x
Derepyxis amphora Stokes	x	---	---
Synura uvella Ehrenberg	x	---	---
Dinobryon divergens Imhoff	x	---	---
D. tabellariae (Lemm.) Pascher	x	---	x
Borzia trilocularis Cohn	---	---	x
Oscillatoria limnetica Lemmermannn ..	x	---	---
Anabaena affinis Lemmermann	x	x	x

PART III

ALGAE ASSOCIATED WITH THE MUCILAGE OF CYANOPHYTA

The association of a particular group of algal species as endophytes within the mucilage of blue-green algae is well known. Further study of such algal communities within the region of this survey suggests that they have several distinct characteristics.

1. Cyanophycean Communities of Four Alberta Beaches

Muir Lake.-- Colonies of Aphanocapsa pulchra (Kuetz.) Rabenhorst were found among masses of decaying vegetation in warm shallow water along the beach early in May. Plate A. (below), a photomicrograph, shows the typical appearance of one of these colonies.

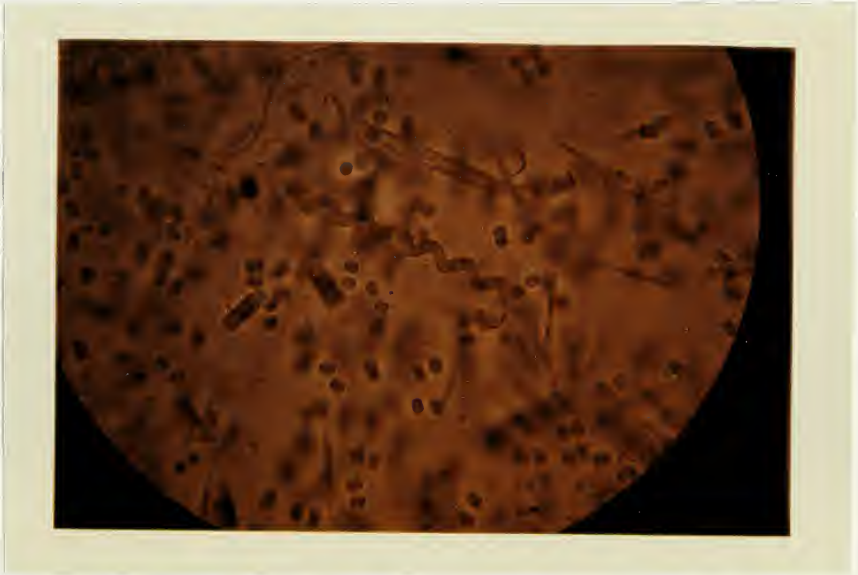

Plate A.

Within these colonies the following species were found:

Pandorina morum (Muell.) Bory
Synura uvella Ehrenberg
Navicula (peregrina ?) Kuetzing
N. (radiosa ?) Kuetzing
Spirulina major Kuetzing
S. princeps (West and West) G.S. West
Oscillatoria acutissima Kufferath
O. tenuis C.A. Agardh

Tychoplanktonic in the same mass of decaying vegetation were the following algae:

Scenedesmus quadricauda var. quadrispina (Chod.) G.M. Smith
Mougeotia sp.
Zygnema sp.
Spirogyra sp.
Navicula (peregrina ?) Kuetzing
N. radiosa Kuetzing
Tabellaria sp.
Dinobryon sertularia Ehrenberg
Peridinium cinctum (Muell.) Ehrenberg
Oscillatoria limosa (Roth) C.A. Agardh

The only algae common to the two environments were two species of diatoms, Navicula (peregrina ?)

Kuetzing and Navicula (radiosa ?) Kuetzing.

Edmonton Beach.-- Within the colonial mucilage of Nostoc pruniforme C.A. Agardh cast up on the beach in a partly decayed state were the following:

Chlamydomonas globosa Snow
Euglena elongata Schewiakoff
E. gracilis Klebs
Chroococcus prescottii Drouet and Daily
Coelosphaerium pallidum Lemmermann
Aphanothece clathrata G.S. West
Oscillatoria amphibia C.A. Agardh
O. chlorina Kuetzing
Navicula (gibba ?) Kuetzing

Only three species contained in the colony were also found externally in the plankton. These were Chroococcus prescottii Drouet and Daily, Coelosphaerium pallidum Lemmermann and Oscillatoria limnetica Lemmermann.

Astotin Lake.-- Large floating masses of algae from a heavy Microcystis bloom on the lake often accumulated to form "soupy" masses along windward shores where it remained for several days. Many community adjustments must have occurred in this mass, because its composition is different from the type found in open water at the same time. The soupy mass was predominantly made up of

Myxophyceae, about eighty-five percent by volume, whereas the euplankton contained only about fifty percent of blue-green algae by volume.

Thus the mass was a distinct and relatively stable community, but the component species were not within a colonial mucilage.

A representative sample contained the following species:

Euglena minuta Prescott
Microcystis aeruginosa Kuet., Emend Elenkin
Spirulina sp.
Spirulina major Kuetzing
Oscillatoria sp.
O. angusta Koppe

Half Moon Lake.-- Intense blooms of blue-green algae occur in this lake from late May to late August. A type of community similar to that described for windward shores of Astotin Lake is to be found on the lake floor wherever the water is no more than four feet deep.

A representative sample contained these species of algae:

Euglena deses Ehrenberg
Microcystis aeruginosa Kuetz., Emend Elenkin
Spirulina laxissima G.S. West
Aphanizomenon flos-aquae (L.) Ralfs

2. Ecology of Cyanophycean Mucilage Algae

Several conclusions can be drawn from observation of the communities described above.

1) The algal communities within the colonial mucilage of Myxophyceae or in masses of Cyanophycean plankton are similar in structure from lake to lake.

2) Species of algae within the colonial mucilage seldom include species found in the outside environment.

3) Species of algae within the colonial mucilage of blue-green algae are, for the most part, capable of movement, eg. flagellates or species of Oscillatoria or Spirulina.

4) Communities consisting of aggregations of Myxophycean plankton differ from the communities within mucilage. Species within the mucilage are seldom the same as those found outside the mucilage, whereas the plankton masses differ only in the proportions of species from what is to be found in open water farther from the shore.

3. Comparison of Algae found in the Mucilage of Colonial Cyanophyta with those in the Mucilage of Midge Larvae

In order to determine whether or not these unique mucilage communities are restricted to the mucilage of blue-green algae, the mucilaginous sheath enveloping the

larvae of midges (Family Chiromonadae) was examined.

In a typical example, a mucilaginous larval sheath in shallow water along the shore of Astotin Lake was examined and found to contain the follwing species of algae:

Sphaerocystis schroeteri Chodat
Pediastrum boryanum (Turp.) Meneghini
Ankistrodesmus falcatus var. acicularis (A. Braun) G.S. West
Cerasterias staurastroides West and West
Actinastrum gracilimum G.M. Smith
A. hantzschii var. fluviatile Schroeder
Scenedesmus dimorphus (Turp.) Kuetzing
Oscillatoria limnetica Lemmermann
O. tenuis C.A. Agardh
Anabaena sp.
Stephanodiscus niagarae (Ehrenberg) Grunow

All the algae in this list were also found in the external environment. For this reason it seems apparent that there is something unique about the environment within the colonial mucilage of blue-green algae which prevents all but certain groups of algae from being stable members of the community.

PART IV

PREVIOUS RECORDS OF ALBERTA ALGAE

It was apparent at the beginning of this survey that very little study had been made of the algal flora of Alberta. Only one published list has been found and that is only an incidental piece of information published as part of the study of peat areas of central Alberta [3]. Permission has been granted by Dr. E.S. Keeping (nee Dowding) to include the list in this survey, because it contains species not found by the writer.

The following list [4] was obtained from a collection from a bog in Big Lake, four miles north of Winterburn, in September of 1926, identified by Professor C.W. Lowe of the University of Manitoba.

Myxophyceae

Chroococcus turgidus (Kuetz.) Naeg.

C. limneticus Lemm.

C. macrococcus (Kuetz.) Raben.

Gloeocapsa fusco-lutea (Naeg.) Kuetz.

Aphanothece saxicola Naeg.

Microcystis sp.

Gomphosphaeria aponina Kuetz.

Merismopedia tenuissima Lemm.

Lyngbya aerugineo-caerulea (Kuetz.) Gomont

Stigonema minutum (Ag.) Hass

Also fragments of Oscillatoria, Rivularia, Nostoc, and Anabaena.

Bacillarieae

Amphora ovalis Kuetz.

Cymbella cymbiformis Ehr.

C. cymbiforma var. parva (W. Sm.) H.V.H.

C. gastroides Kuetz. forma minor H.V.H.

C. ehrenbergii Kuetz.

C. lanceolata Ehr.

Stauroneis phoenocenteron Ehr.

Navicula viridis Kuetz.

N. oblonga Kuetz.

N. radiosa Kuetz.

N. radiosa var acuta (W. Sm.) H.V.H.

N. cuspidata Kuetz.

N. sphaeroplea Kuetz.

N. iridis Ehr.

N. iridis var. producta H.V.H.

Gomphonema constrictum Ehr.

G. intricatum Kuetz.

Epithemia turgida (Ehr.) Kuetz.

E. argus Kuetz.

Rhopalodia gibba (Kuetz.) O. Muell.

Synedra ulna var. splendens (Kuetz.) H.V.H.

Fragilaria crotonensis (A.M. Edw.) Kitton

F. capucina Desmaz

Surirella sp?

Hantzschia amphioxus (Ehr.) Grunow

H. amphioxus var. elongata H.V.H.

Chlorophyceae

Oocystis solitaria Wittr.

Tetraedon minimum (A.Br.) Hansg.

Scenedesmus quadricauda (Turp.) Breb.

Coelastrum microporum Naeg.

Pediastrum tetras (Ehr.) Ralfs

Pediastrum boryanum (Turp.) Menegh.

Cylindrocapsa conferta W.West

Spirogyra (not in conjugation)

Euastrum dubium Naeg.

E. insulare (Wittr.) Roy.

Cosmarium granatum Breb.

C. rectangulare Gran.

C. impressulum Elfv.

C. laeve Raben.

C. pokornyanum (Grun.) W.W. and G.S.W.

C. hammeri Reinsch

C. quadrum Lund.

C. humile (Gay) Nordst. var. striatum (Boldt) Schm.

C. subcucumis Schm.

C. reniforme (Ralfs) Archer

C. subcrenatum Hantz.

C. botrytis (Bory) Menegh.

C. margaritaceum (Lund.) Roy and Bisset

Staurastrum muticum Breb.

S. polymorphum Breb.

S. alternans Breb.

S. paradoxum Meyen

Bulbochaete sp? (Not in fruit)

Chara sp.

PART V

ANNOTATED LIST OF SOME ALBERTA ALGAE

Introductory Notes

The following annotated list contains some 290 species of algae. Of particular interest in the one species of the class Rhodophyceae, Thorea ramosissima Bory found washed up on the beach of Lac Ste. Anne on a Scirpus stem in August of 1958. The writer is unaware of any reports of this species occurring this far north (54° latitude). It would be interesting to know if this species also occurs in Cold Lake, another large body of water, situated on the eastern border of Alberta and one half degree further north.

Because of the special procedures and difficulties involved in the identifying of the Bacillariophyceae, they comprise only a small number in this list. However, it is estimated that over seventy species were collected.

Species of which the identification is uncertain (because of the lack of complete keys and other similar literature) are illustrated or described in the appendix.

Locations and Features of Lakes Sampled 1/

1 Allan Lake--Section 3, TP. 53, R. 1, W. 5th
A drainage lake (1), over two hundred feet deep at the deepest point, covering an area of about sixty-five acres. Water blooms are not reported for this lake.

2 Antler Lake--Section 14, TP. 52, R. 21, W. 4th.
A seepage lake (2), approximately one square mile in area, known to bloom regularly.

3 Astotin Lake--Section 23, TP. 54, R. 20, W. 4th.
A seepage lake in Elk Island National Park, Astotin Lake is known to bloom regularly. Altitude 2336'.

4 Beaverhill Lake--TP. 51-52, R. 17-18 W.4th.
This is a large shallow(average depth 25 feet) seepage lake which blooms occasionally. Altitude 2202'.

5 Big Chikakoo Lake--S.W. section 34, TP. 53, R. 1, W.5th.
This small drainage lake of about eighty acres extent is not known to bloom.

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(1) Drainage lake-- Stream or spring fed, with an outlet, at least during part of the year.
(2) Seepage lake-- A landlocked lake, with no outlet.
1/ See plate B, p. 39b

6 Cold Lake--TP. 62-64, R. 1-3, W. 4th.
Very large, deep drainage lake.

7 Cooking Lake (South Cooking Lake)-- TP. 51, R. 21, W. 4th.
Drainage lake with a light green color caused by much phytoplankton. Altitude 2419'.

8 Edmonton Beach (Lake)-- N.W. 31, TP. 52, R.1, W. 5th.
Seepage lake, blooms regularly.

9 Gull Lake--TP. 41-42, R.1, W. 5th.
Drainage lake, blooms, but very rarely.

10 Half Moon Lake--S.E. 6, TP. 52, R.21, W. 4th.
Small drainage lake. Intense Aphanizomenon bloom every year.

11 Hanmore Lake-- Sections 19 and 30. TP. 61, R. 17, W. 4th.
Drainage lake. No known blooms.

12 Hasse Lake (Trout Lake)-- Section 11, TP. 52, R. 2, W. 5th.

13 Iosegen Lake-- TP. 63, R. 18, W. 5th.

14 Jackfish Lake-- Section 20, TP. 53, R. 9, W. 4th.

15 Joseph Lake-- Section 1, TP. 50, R. 22, & Sections 6-7, TP. 50, R. 21, W. 4th.

16 (Upper) Kananaskis Lake-- TP. 19, R.9, W.5th.

17 Lac la Biche--TP. 67-68, R. 14-15, W. 4th.
Drainage lake.

18 Lac. Ste. Anne--TP. 54, R. 3, W. 5th.
Drainage lake. No blooms known.

19 Lake Eden--N.W. 13, TP. 53, R. 2, W. 5th.
Drainage lake. Never blooms.

20 Lake Mere-- N.W. 33, TP. 53, R. 1, W. 5th.
Drainage lake. Never blooms.

21 Lesser Slave Lake-- TP. 75, R. 6-14, W.5th.
Very large drainage lake.

22 Lower (Little Kananaskis Lake)- TP. 19, R. 9, W. 5th.

23 Moose Lake-- TP. 55, R.15, W. 5th.

24 Muir Lake--N.W. 31, TP. 53, R. 27, W. 4th.

25 Pigeon Lake-- TP.46, R.1, W. 5th
Drainage lake. Slight bloom.

26 Spring Beach Lake--TP. 59, R. 6, W. 4th.

27 Surprise Lake-- TP. 53, R. 17, W. 5th. Altitude about 5000'.

28 Wabamun Lake-- TP. 52, R. 4-5, W. 5th.
Drainage lake. Blooms regularly.

29 Wildhorse Lake (Nick's Lake)--Section 31, TP. 49, R. 26, W. 5th.

Note

TP. - Township number.

R. - Range number.

4th or 5th - Meridian number.

Bloom - Bloom, as used above, refers to the condition which occurs when a lake is so densely populated with phytoplankton that the water is markedly colored.

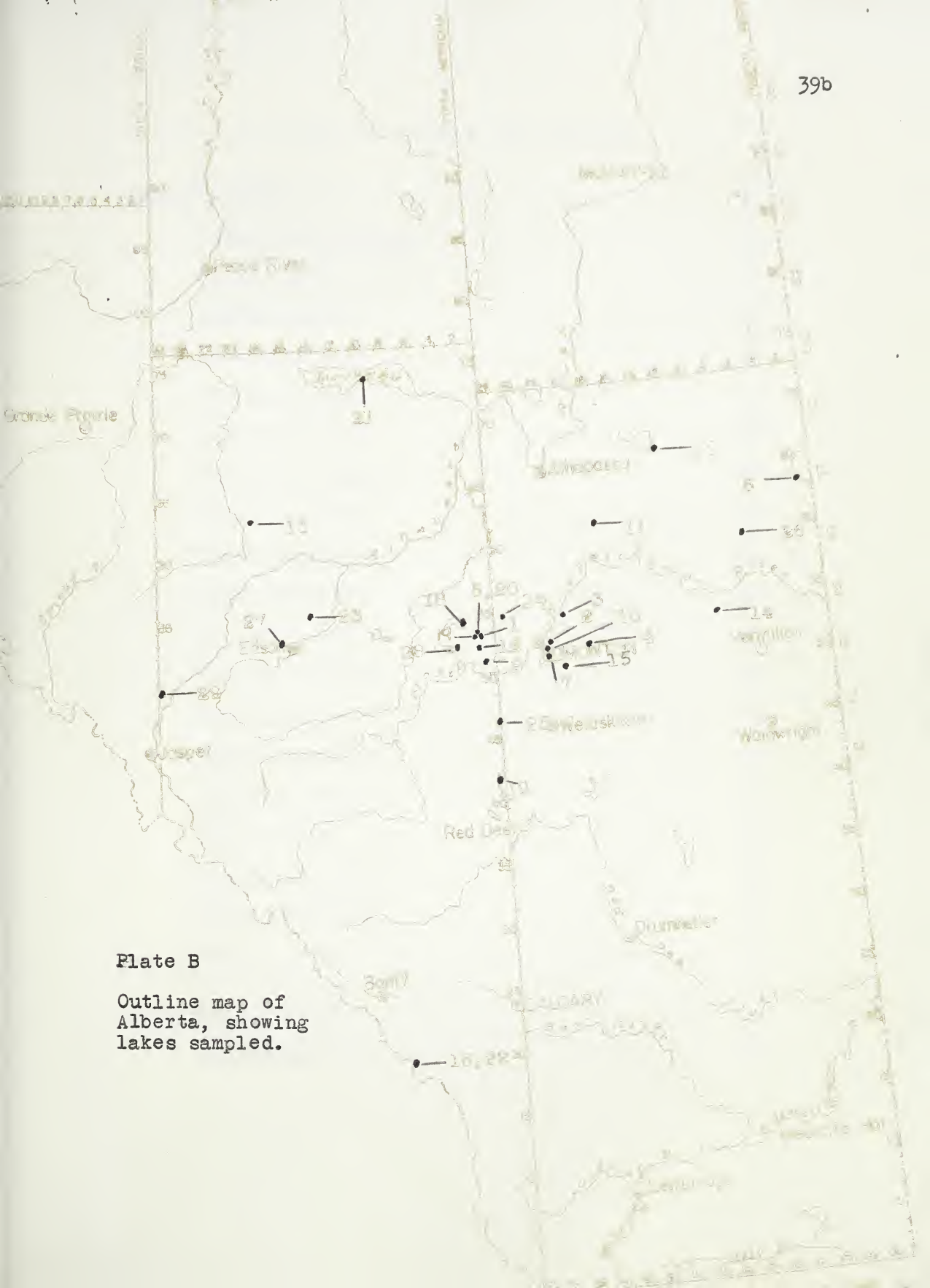

Plate B

Outline map of Alberta, showing lakes sampled.

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THE ANNOTATED LIST

The references used for the identification of species are: 6/, 7/, 9/, 11/, 12/, 13/, 14/ and 15/ .

CHLOROPHYCEAE

Chlamydomonadaceae

Chlamydomonas angulosa Dill

In mats of floating Spirogyra sp. along shore. Gull L. Early April.

C. cienkowskii Schmidle

In mats of algae in grassy pasture slough near Waskatenau. Mid-April.

C. globosa Snow

Planktonic and tychoplanktonic. Hasse L.; Big Chikakoo L.; Astotin L.; Edmonton Beach; Holden sewage lagoon; in a pool by iron bearing springs in White Mud Park, Edmonton. All summer.

C. mucicola Schmidle

Planktonic. Lake Eden. September.

C. pseudopertyi Pascher

Enrichment culture of bottom sand, Muir L. Sphagnum squeezings, Elk Island Park. September.

C. snowii Printz

Almost unialgal culture in University of Alberta greenhouse tank, also Holden sewage lagoon.

Volvocaceae

Gonium formosum Pascher

In mats of algae, grassy pasture slough near Waskatenau. April.

G. pectorale Mueller

Planktonic. Astotin L. September

Pandorina morum (Muell.) Bory

Planktonic, Astotin Lake. June. Tychoplanktonic, Muir L. May.

Eudorina elegans Ehrenberg

Planktonic in Lake Eden, September; Lake Mere, July and August; Astotin L., all summer; Iosegen L., and tychoplanktonic in Antler L., July; and in a grassy pasture slough near Waskatenau, May.

E. stagnale Wolle

Planktonic. Lac. Ste. Anne. August

Volvox globator Linnaeus

Major part of Lake Mere plankton all summer. Planktonic, Lake Eden, September and Muir L., May and September.

Spondylomorum quaternarium Ehrenberg

Grassy pasture slough near Waskatenau. May.

Palmellaceae

Palmella mucosa Kuetzing

Tychoplanktonic. Astotin L., grassy barnyard slough near Waskatenau. April.

Sphaerocystis schroeteri Chodat

Planktonic and tychoplanktonic. Cooking L.; Lake Eden; Edmonton Beach; grassy slough, Elk Island Park; Drepanocladus bog north of Stony Plain. April to July.

Gloeocystis major Gerneck ex Lemmermann

Planktonic and tychoplanktonic. Cooking L., Gull L., Astotin L., Muir L., Surprise L. June to September.

G. vesiculosa Naegeli

In mats of algae, barnyard slough near Waskatenau. April.

Asterococcus limneticus G.M. Smith

Enrichment culture, Lake Mere bottom sand.

Tetrasporaceae

Tetraspora lacustris Lemmermann

Planktonic. Lake Mere. July, August.

T. gelatinosa (Vauch.) Desvaux

Attached to stones in swiftly flowing stream along Kananaskis Highway. August.

Schizochlamys sp.

(Not S. compacta Prescott or S. gelatinosa A. Braun.)

Planktonic. Astotin L. May.

Chlorangium stentorinum (Ehrenb.) Stein

Epiphytic on Dinobryon sertularia Ehrenberg in Allan L. August.

Ulotrichaceae

Ulothrix aequalis Kuetzing

Attached to rocks and wood. Cold L. May. Enrichment culture, Lake Mere bottom sand.

U. cylindricum Prescott

Attached to rocks and wood. Cold L. May.

U. subconstricta G.S. West

In mats of algae. Grassy slough, Elk Island Park; near Waskatenau. April.

U. subtilissima Rabenhorst

Tychoplanktonic. Cooking L., Hanmore L., Astotin L., grassy slough near Waskatenau. May to September.

U. tenerrima Kuetzing

Forming mats in shallow pool. Iron bearing springs, White Mud Park, Edmonton. July.

U. variabilis Kuetzing

Sphagnum squeezings, Elk Island Park. September.

U. zonata (Weber and Mohr) Kuetzing

Attached to rocks and wood. Cold L. April.

Hormidium sp.

Sand enrichment culture. Astotin L.

Uronema elongata Hodgetts

Attached to mud along shore. Lake Eden. June.

Stichococcus badillaris Naegeli

Soil enrichment culture. Olds.

Geminella mutabilis (de Breb.) Wille

Entangled among algae, Drepanocladus bog north of Stony Plain. September.

Radiofilum irregulare (Wille) Brunnthaller

Entangled among Tetraspora sp., swiftly flowing stream along Kananaskis highway. August.

Microsporaceae

Microspora pachyderma (Wille) Lagerheim

Forming mats in pools in iron-bearing springs. White Mud Park, Edmonton. May to August.

M. stagnorum (Kuetz.) Lagerheim

Entangled in mats of algae in grassy sloughs. North of Spruce Grove; below University of Alberta campus on river flats. May.

M. tumidula Hazen

In mats of algae. Pool below ski hill, White Mud Park, Edmonton. May.

M. willeana Lagerheim

In mats of algae cast up on shore. Astotin L. June.

Sphaeroplea annulina (Roth) C.A. Agardh

In mats of algae. Grassy slough near Waskatenau. May.

Chaetophoraceae

Stigeoclonium nanum Kuetzing

Plankton enrichment culture. Astotin L.

S. polymorphum (Franke) Heering

Attached to Scirpus sp. stem. Gull L., Cooking L.; Equisetum stem, Lake Eden. May and June. Soil enrichment culture, Warburg.

S. stagnatile (Hazen) Collins

Attached to Scirpus sp. stem. Gull L. May.

Chaetophora sp.

Attached to Scirpus sp. stem cast up on shore. Cooking L. June.

Protoderma viride Kuetzing

Soil enrichment culture, Duchess.

Chaetopeltis sp.

Attached to Scirpus sp. and Typha sp. stems cast up on shore. Astotin L. June to September.

Aphanochaete polychaete (Hazen) Fritsch

Epiphytic on Cladophora sp. cast up on shore. Lac Ste. Anne. June to August.

A. repens A. Braun

Epiphytic on Cladophora sp. cast up on shore. Lac Ste. Anne, Edmonton Beach. June.

Protococcaceae

Protococcus viridis C.A. Agardh

Aerial and subaerial on a variety of moist substrates. eg. bark, soil, greenhouse pots. Widespread. Adtively vegetative any time of year if not frozen. Loose filaments in moist environments and spherical or slightly compressed solitary cells in drier environments.

Coleochaetaceae

Coleochaete sp.

Benthic and loosely attached to aquatics. Astotin L. Very common in September.

C. soluta (de Breb.) Pringsheim

Tychoplanktonic. Muir L. July.

Chaetomorpha linum (O.F. Muell) Kuetzing

Identification of this species uncertain. (Refer to drawings.) Possibly Rhizoclonium fontanum Kuetz. Tychoplanktonic. Astotin L., Allan L., and benthic in Lake Eden. June and July.

Cladophoraceae

Cladophora callicoma Kuetzing

Attached to stones, swiftly flowing water, White Mud Creek, Edmonton. May. Soil enrichment culture; greenhouse, University of Alberta.

C. crispata (Roth) Kuetzing

Aquarium, greenhouse, University of Alberta.

C. fracta (Dillw.) Kuetzing

Tychoplanktonic and washed up on shore. Cooking L., Beaverhill L. June.

C. glomerata (L.) Kuetzing

Tychoplanktonic. Hanmore L. May.

Pithophora oedogonia (Mont.) Wittrock

Entangled among other algae. Drepanocladus bog, north of Stony Plain. September.

Oedogoniaceae

Oedogonium angustissimum West and West

Enrichment culture. Muir L. Bottom sand.

O. aereoliferum (Jao) Tiffany

Tychoplanktonic. Astotin L. May.

O. sociale Wittrock

In mats of algae. Pool below ski hill, White Mud Park, Edmonton. May.

Chlorococcaceae

Chlorococcum humicola (Naeg.) Rabenhorst

In mats of algae, Drepanocladus bog north of Stony Plain. September. In hydroponic mineral solution, greenhouse, University of Alberta.

Characiaceae

Characium ambiguum Hermann

Epiphytic on algae and higher plants. Lac Ste. Anne, Lake Eden, Cold L., Edmonton Beach. May and June.

C. debaryanum (Reinsch) DeToni

Epiphytic on Microspora stagnorum (Kuetz.) Lag.

Grassy pool on river flats below University of Alberta campus. May.

C. gracilipes Lambert

Epiphytic on filamentous algae. Astotin L. Grassy slough, Elk Island Park. April and May.

C. hookeri (Reinsch) Hansgirg

Epiphytic on filamentous algae. Shallow pool below ski hill, White Mud Park, Edmonton. May.

C. limneticum Lemmermann

Epiphytic on a rotifer. Cooking L. June.

C. obtusatum A. Braun

Epiphytic on filamentous algae. Astotin L. July.

Hydrodictyaceae

Euastropsis richteri (Schmidle) Lagerheim

In mucilage of Cyanophyta. Drepanocladus bog north of Stony Plain. September.

Pediastrum araneosum (Racib.) G.M. Smith

Planktonic. Surprise L. July.

P. biradiatum var. emarginatum fa. convexum Prescott
In mucilage of Cyanophyta, Drepanocladus bog north of Stony Plain. September.

P. boryanum (Turp.) Meneghini
Planktonic and tychoplanktonic. Cooking L., Gull L., Edmonton Beach, Beaverhill L., Joseph L., Hanmore L., Pigeon L., Wabamun L., Muir L., Astotin L.
May to September.

P. boryanum var. undulatum Wille
Plankton enrichment culture. Astotin L.

P. duplex Meyen
Planktonic. Astotin L. July.

P. duplex var. clathratum (A.Braun) Lagerheim
Planktonic. Astotin L. July.

P. duplex var. cohaerens Bohlin
Planktonic. Allan L. June.
Plankton enrichment culture. Astotin L.

P. duplex var. gracilimum West and West
Planktonic. Astotin L. July.

P. duplex var. reticulatum Lagerheim
Planktonic. Joseph L., Muir L., Astotin L. September, July, July, respectively.

P. glanduliferum Bennet

Planktonic. Allan L. June.

P. sculptatum G.M. Smith

Plankton enrichment culture, Astotin L.

P. tetras (Ehrenb.) Ralfs ? (see drawing)

Tychoplanktonic. Muir L. July.

Coelastraceae

Coelastrum microporum Naegeli

Planktonic. Cooking L., Muir L., Astotin L., Coal Valley strip mine pit. June to October.

Oocystaceae

Chlorella vulgaris Beyerinck

Planktonic. Lake Eden, September. Entangled among other algae, Drepanocladus bog north of Stony Plain. September. Daysland and Holden sewage lagoons. Hydroponic mineral solutions, greenhouse, University of Alberta.

C. ellipsoidea Gerneck

Among other algae, barnyard slough near Waskatenau, April. Holden sewage lagoon. Hydroponic mineral solution, greenhouse, University of Alberta.

Westella botryoides (W. West) de Wildemann

Plankton enrichment culture. Astotin L. Among other algae, Drepanocladus bog north of Stony Plain, September

W. linearis G.M. Smith

Tychoplanktonic. Astotin L. July.

Dictyosphaerium ehrenbergianum Naegli

Planktonic and tychoplanktonic. Edmonton Beach, Astotin L., Surprise L. June and July.

D. pulchellum Wood

Planktonic and tychoplanktonic. Cooking L., Edmonton Beach, Gull L., Big Chikakoo L., Astotin L. June to August. Enrichment culture, bottom sand, Lake Mere.

Planktosphaeria gelatinosa G.M. Smith

Planktonic. Lake Mere, Big Chikakoo L., Muir L. July and August.

Oocystis borgei Snow

Planktonic. Lake Eden, Muir L., Astotin L. July to September.

O. crassa Wittrock

Planktonic. Cooking L., August.

O. elliptica W. West

Planktonic. Cooking L., Edmonton Beach. June to August.

O. eremosphaeria G.M. Smith

Tychoplanktonic. Gull L. May and June.

O. lacustris Chodat

Planktonic. Gull L. June and July.

O. novae-semliae Wille

Planktonic. Cooking L. July and August.

O. parva West and West

Planktonic. Edmonton Beach, Big Chikakoo L., Astotin L. July to September.

O. pusilla Hansgirg

Planktonic. Edmonton Beach, Cooking L., June.

O. submarina Lagerheim

Planktonic. Edmonton Beach. September.

Ankistrodesmus convolutus Corda

Entangled among other algae attached to stones in swiftly flowing water. White Mud Creek, Edmonton. May.

A. falcatus (Corda) Ralfs

Tychoplanktonic. Gull L., Edmonton Beach, Allan L., Astotin L. April to June.

Entangled among other algae, greenhouse pool, University of Alberta. Grassy barnyard slough, Waskatenau and Willingdon. April and May.

A. falcatus var. acicularis (A. Braun) G.S. West
Planktonic. Astotin L. April to May.

A. falcatus var. mirabilis (West and West) G.S.West
Planktonic. Joseph L. September.

A. falcatus var. stipitatus (Chod.) Lemmermann
Planktonic. Allan L. June. Sphagnum moss squeezings, Elk Island Park. September.

A. falcatus var. tumidus (West and West) G.S. West
In mucilage of Cyanophyta, Drepanocladus bog north of Stony Plain. September.

A. spiralis (Turner) Lemmermann
Planktonic. Allan L. June.

Closteriopsis longissima Lemmermann
Planktonic. Lac Ste. Anne. August.

Selenastrum westii G.M. Smith
Planktonic. Cooking L., Jun. Muir L., October. In mats of algae in ditch north of Stony Plain. September.

S. gracile Reinsch
In mucilage of Cyanophyta, Drepanocladus bog north of Stony Plain. September.

Quadrigula lacustris (Chod.) G.M. Smith
In mucilage of Cyanophyta, Drepanocladus bog north of Stony Plain. September.

Tetraedon duospinum Ackley
Planktonic. Allan L. June.

T. trigonum var. gracile (Reinsch) deToni
Planktonic. Muir L. July and August.

Cerasterias staurastroides West and West
Planktonic. Cooking L., Allan L., Astotin L. June.

Scenedesmaceae

Scenedesmus abundans var. brevicauda G.M. Smith
Planktonic. Cooking L. June. Plankton enrichment culture, Astotin L. June.

S. acuminatus (Lag.) Chodat
Tychoplanktonic. Cooking L. June.

S. arcuatus var. platydisca G.M. Smith
Plankton enrichment culture, Astotin L.

S. bijuga (Turp.) Lagerheim
Planktonic and tychoplanktonic. Gull L., Allan L., Surprise L. May to July. Planktonic enrichment culture, Astotin L. Mud enrichment culture, Lake Mere. Soil enrichment culture, Duchess.

S. bijuga var. alternans (Reinsch) Hansgirg

Planktonic. Cooking L., Edmonton Beach, Allan L. June and July. Greenhouse pool, University of Alberta. Lacombe sewage lagoon.

S. dimorphus (Turp.) Kuetzing

Planktonic and tychoplanktonic. Cooking L., Allan L., Beaverhill L., Astotin L., Kananaskis L. May to August. Daysland and Holden sewage lagoons.

S. incrassatulus Bohlin

Planktonic and tychoplanktonic. Beaverhill L., Muir L., June and October respectively.

S. incrassatulus var. mononae G.M. Smith

Planktonic. Edmonton Beach. June. Soil and enrichment culture, Duchess.

S. longus var. naegelii (de Breb.) G.M. Smith

Tychoplanktonic. Beaverhill L. June.

S. obliquus (Turp.) Kuetzing

Holden sewage lagoon.

S. opoliensis var. contacta Prescott

Planktonic. Astotin L. May.

S. quadricauda (Turp.) De Brebisson
Planktonic and tychoplanktonic. Cooking L., Pigeon L., June and October respectively. Plankton enrichment culture, Astotin L. Lacombe sewage lagoon. Hydroponic mineral solution, greenhouse, University of Alberta.

S. quadricauda var. longispina (Chod.) G.M. Smith
Planktonic. Muir L., October; Astotin L., May and June. Lacombe sewage lagoon. Sphagnum moss squeezings, Elk Island Park, September.

S. quadricauda var. maximus West and West
Greenhouse tank, University of Alberta.

S. quadricauda var. parvus G.M. Smith
Planktonic. Cooking L., Astotin L. July and August. Sphagnum moss squeezings, Elk Island Park, September.

S. quadricauda var. quadrispina (Chodat.) G.M. Smith
Planktonic. Edmonton Beach, Beaverhill L., Muir L., Astotin L. June and July. Soil enrichment cultures, Didsbury and Chancellor.

S. quadricauda var. westii G.M. Smith
Planktonic. Muir L., Astotin L. July to October.

Actinastrum gracilimum G.M. Smith
Planktonic. Cooking L., Astotin L. June to August.

A. hantzschii Lagerheim

Tychoplanktonic. Lac Ste. Anne, Lake Eden. June.

A. hantzschii var. elongatum G.M. Smith

Planktonic. Cooking L. June. Entangled among other algae, pool by iron-bearing springs, White Mud Park, Edmonton, July.

A. hantzschii var. fluviatile Schroeder

Tychoplanktonic. Wabamun L., Astotin L., May and June.

Crucigenia quadrata Morren

Planktonic. Cooking L., Allan L., Beaverhill L., Joseph L. June to September.

C. rectangularis (A. Braun) Gay

Planktonic. Allan L. June.

Zygnemataceae

Mougeotia spp.

At least twelve different forms were found but none in fruit, making identification of the species impossible. Planktonic, tychoplanktonic, benthich, in ditches, ponds and running water. From April to October.

Spirogyra spp.

At least fourteen forms found, only a few of them in fruit. Environment and dates as for Mougeotia.

S. flavescens (Hass) Kuetzing

Tychoplanktonic. Gull L. June.

S. protecta Wood

Planktonic. North Saskatchewan River. September.

S. reflexa Transeau

Plankton enrichment culture. Astotin L.

Zygnema spp.

A number of forms found but none were fruiting. Planktonic, tychoplanktonic and from ponds, intermingled with other algae, usually other Zygnemataceae. Hondo, Lake Mere, Astotin L.

Desmidaceae

Closterium aciculare Tuffen West

Mud enrichment culture, Lake Mere.

C. abruptum West

Planktonic. Kananaskis L., Moose L. July and August.

C. acutum de Brebisson

Hydroponic mineral solution, greenhouse, University of Alberta.

C. ehrenbergii Meneghini

In mats of algae. Shallow pool of iron-bearing springs, White Mud Park, Edmonton. June and July.

C. peracerosum var. elegans G.S. West

Planktonic. Astotin L. July.

C. strigosum de Brebisson

Tychoplanktonic. Beaverhill L. June

C. venus Kuetzing

Planktonic. Allan L., Astotin L. June.

Pleurotaenium truncatum (de Breb.) Naegeli

In mucilage of Cyanophyta, Drepanocladus bog north of Stony Plain. September.

Euastrum pinnatum Ralfs

Among other algae in Drepanocladus bog north of Stony Plain. September.

Cosmarium cyclicum Ludegardh

Planktonic. Cooking L. July.

C. contractum var. papillatum W. and G.S. West

Greenhouse pool, University of Alberta.

C. intermedium Delp.

Planktonic. Allan L. August.

C. lundellii var. ellipticum West

Mud enrichment culture, bottom mud, Lake Mere.

C. lundellii var. aethiopicum West and G.S. West

Tychoplanktonic. Edmonton Beach. September.

C. nitidulum De Not

Planktonic. Edmonton Beach. June.

C. obtusatum Schmidle

Planktonic and tychoplanktonic. Astotin L. July.

C. pachydermum Lundegardh

Planktonic. Muir L. July. Mud enrichment culture, Lake Mere bottom sand.

C. radiosum Wolle

Entangled among other algae. Grassy slough five miles north of Spruce Grove. July.

Staurastrum gracile Ralfs

Planktonic. Edmonton Beach. June.

S. granulosum (Ehrenb.) Ralfs fa. connexa

Planktonic. Muir L. July.

S. paradoxum Meyen

Planktonic and tychoplanktonic. Lac Ste. Anne, Hasse L., Jospeh L., Muir L., Astotin L., Wildhorse L., Little Kananaskis L., roadside dugout, Donnelly. July and August.

S. polymorphum de Brebisson

Planktonic. Allan L. June.

CHAROPHYCEAE

Characeae

Tolypella sp.

Benthic. Big Chikakoo L. Year round.

Chara sp.

Benthic. Allan L., Big Chikakoo L., Muir L., Lake Eden. Year round.

XANTHOPHYCEAE

Stipitococcaceae

Stipitococcus capense Prescott

Epiphytic on planktonic diatoms. Muir L. August.

Mischococcaceae

Mischococcus confervicola Naegeli

Epiphytic on Edorina elegans Ehrenberg. Astotin L. June.

Characiopsidaceae

Characiopsis acuta (A. Braun) Borzi

Epiphytic on Cladophora sp. Astotin L. June.

C. pyriformis (A. Braun) Borzi

Epiphytic on filamentous algae. Grassy slough, Elk Island Park.. April.

Chlorotheciaceae

Ophiocytium cochleare (Eichw.) A. Braun

Free-floating, among other algae. Grassy slough, Elk Island Park. April.

O. desertum Printz

Epiphytic on filamentous algae in grassy sloughs. On river flats below the University of Alberta campus. May.

O. desertum var. minor Prescott

Epiphytic on filamentous algae in grassy sloughs. On river flats below the University of Alberta campus; five miles north of Spruce Grove; in Elk Island Park. May.

O. gracilipes Rabenhorst

Epiphytic on filamentous algae. Grassy slough, Elk Island Park. May.

Ophiocytium parvulum (Perty) A. Braun

Free-floating among mats of algae in grassy sloughs. On river flats below the University of Alberta campus; in Elk Island Park. May.

CHRYSOPHYCEAE

Mallomonadaceae

Mallomonas sp. (see plate)

Planktonic and tychoplanktonic. Cooking L., Muir L., Astotin L., grassy slough near Waskatenau. April to August.

Syncryptaceae

Derepyxis amphora Stokes

Epiphytic on filamentous algae. Grassy slough in Elk Island Park. May.

Synuraceae

Synura adamsii G.M. Smith

Tychoplanktonic. Beaverhill L. June.

S. uvella Ehrenberg

Tychoplanktonic. Lake Eden, Wabamun L., Muir L., White Mud creek, grassy slough in Elk Island Park. April to July.

Ochramonadaceae

Dinobryon bavaricum Imhoff

Planktonic. Willingdon slough. May.

D. divergens Imhoff

Tychoplanktonic. Grassy slough, Elk Island Park. May.

D. sertularia Ehrenberg

Planktonic. Allan L., Hanmore L., Muir L., Little Kananaskis L., Surprise L., Moose L., slough, Willingdon, May to September.

D. tabellariae (Lemm.) Pascher

Tychoplanktonic. Grassy slough, Elk Island Park. May.

Rhizochrysidaceae

Chrysamoeba radians Klebs

Stony Plain sewage lagoon.

Lagynion reductum Prescott

Epiphytic on Cladophora sp. Hanmore L. May

BACILLARIOPHYCEAE

Melosira granulata (Ehrenb.) Ralfs

Planktonic. Lac Ste. Anne, Lac La Biche, Iosegen L., Wabamun L., Astotin L. June and July.

Stephanodiscus astrea (Ehrenb.) Grunow

Planktonic. Lesser Slave L. August.

S. niagarae Ehrenberg

Planktonic. Lac Ste. Anne, Cooking L., Lake Eden, Lac La Biche, Hanmore L., Wabamun L., Astotin L. May to September.

Chaetoceros elmorei Boyer

Planktonic. Cooking L. August.

Tabellaria flocculosa

Planktonic. Cooking L. June.

Asterionella formosa Hass

Planktonic. Lac Ste Anne, Lake Eden, Gull L., Big Chikakoo L., Wabamun L., Muir L., Astotin L., Little Kananaskis L., Kananaskis L., North Saskatchewan River. June to October.

Surirella sentis

Planktonic. Cooking L., Antler L. July.to September.

EUGLENOPHYCEAE

Euglenaceae

Euglena acus Ehrenberg

Planktonic. Willingdon slough. May.

E. deses Ehrenberg

Tychoplanktonic. Cooking L, Half Moon L., grassy pasture slough near Waskatenau, pool by iron-bearing springs, White Mud Park, Edmonton. April, July and August.

E. elongata Schweiakoff

In mucilage of Cyanophyta cast upon the beach at Edmonton Beach. August.

E. gracilis Klebs

Tychoplanktonic. Edmonton Beach. September.

E. minuta Prescott

Planktonic. Astotin L. (during heavy bloom) July.

E. oxyuris Schmarda var. minor Prescott

Tychoplanktonic. Beaverhill L., grassy slough, Elk Island Park. April to June.

Phacus curvicauda Swirenko

Plankton enrichment culture. Muir L.

Trachelomonas abrupta (Swir.) Deflandre

Planktonic and tychoplanktonic. Astotin L., grassy pasture slough near Waskatenau. April to July.

T. pulcherrima Playfair

Tychoplanktonic. Grassy slough, Elk Island Park. May.

T. superba var. spinosa Prescott

Tychoplanktonic. Grassy slough, Elk Island Park. May.

DINOPHYCEAE

Glenodiniaceae

Glenodinium gymnodinium Penard

Planktonic. Hanmore L. May.

Peridiniaceae

Peridinium cinctum (Muell.) Ehrenberg

Planktonic. Allan L., Muir L., May to October.

P. gatunense Nygaard

Planktonic. Allan L. June.

Ceratiaceae

Ceratium hirundinella (O.F. Muell.) Dujardin

Planktonic. Allan L., Lac La Biche, Iosegen L., Hanmore L., Muir L., Kananaskis L., Moose L., Spring Beach L., strip mine pits, Coal Valley, roadside dugout, Donnelly, slough near Willingdon. May to August.

MYXOPHYCEAE

Chroococcaceae

Chroococcus dispersus (Keissl.) Lemmermann

Planktonic. Muir L. August.

C. limneticus Lemmermann

Planktonic. Cooking L., Wabamun L., Astotin L. June to August.

C. minimus (Keissl.) Lemmermann

Planktonic. Gull L. July.

C. minor (Kuetz.) Naegeli

Tychoplanktonic and adhering to submerged objects. Lac Ste. Anne, Cooking L. August and June, respectively.

C. minutus (Kuetz.) Naegeli

In mats of algae. Drepanocladus bog north of Stony Plain. September.

C. pallidus Naegeli

Tychoplanktonic and attached to other algae. Lac Ste. Anne, Wildhorse L. July and August.

C. prescottii Drouet and Daily

Tychoplanktonic. Lac Ste. Anne, Edmonton Beach, Wabamun L. June to September.

C. turgidus (Kuetz.) Naegeli

Planktonic. Muir L. August.

Gloeocapsa calcarea Tilden

On shaded moist soil. South riverbank below the University of Alberta campus. July.

Aphanocapsa delicatissima West and West

Planktonic. Joseph L. September.

A. pulchra (Kuetz.) Rabenhorst

Tychoplanktonic. Muir L. May.

Microcystis aeruginosa Kuetz.; emend Elenkin

Planktonic and tychoplanktonic. Cooking L.; Half Moon L.; Gull L.; Edmonton Beach; Hasse L.; Astotin L.; Wildhorse L.; Surprise L.; Bow River; Drepanocladus bog north of Stony Plain. May to September.

M. incerta Lemmermann

Planktonic. Cooking L., Muir L. August.

Merismopedia elegans A. Braun

In mucilage of Cyanophyta, Drepanocladus bog north of Stony Plain. September.

M. glauca (Ehrenb.) Naegeli

Planktonic. Joseph L. September.

M. punctata Meyen

Planktonic. Cooking L. June.

M. tenuissima Lemmermann

Planktonic and tychoplanktonic. Cooking L.; Edmonton Beach; Allan L.; Joseph L.; on pebbles in fast water, White Mud Creek, Edmonton. June to September.

Synechoccus aeruginosa Naegeli

In mucilage of Cyanophyta, Drepanocladus bog north of Stony Plain. September.

Gloeothece rupestris (Lyngb.) Bornet

Tychoplanktonic. Antler L., Wabamun L. June

Rhabdoderma lineare Schmidle and Lauterborn

Planktonic. Cooking L. July.

Dactylococcopsis acicularis Lemmermann

Sphagnum moss squeezings. Elk Island Park. September.

Cyanarcus hamiformis Pascher

Planktonic. Joseph L. September.

Aphanothece castagnei (de Breb.) Rabenhorst

Benthic, becoming free-floating and drifting in to shore, also intermingled with other algae in bogs. Pigeon L., Astotin L., Drepanocladus bog north of Stony Plain. May, June, September and October.

A. clathrata G.S. West

Tychoplanktonic. Edmonton Beach. September.

A. nidulans G.S. West

Planktonic. Cooking L. July. Barnyard slough near Waskatenau. April.

A. saxicola Naegeli

Holden sewage lagoon.

Coelosphaerium naegelianum Unger

Planktonic. Lac Ste. Anne, Cooking L., Lake Mere, Iosegen L., Big Chikakoo L., Muir L., Astotin L. June to August.

C. pallidum Lemmermann

Planktonic. Cooking L., Lake Eden, Edmonton Beach. July to September.

Dermocarpaceae

Pluto caldarius (Tilden) J.J. Copeland

Sphagnum moss squeezings. Elk Island Park. September.

Chamaesiphonaceae

Chamaesiphon sp.

Growing on stone in enrichment culture. Astotin L.

Oscillatoriaceae

Spirulina sp.

Trichomes loosely spiralled, (1 turn to 3.2 μ) with spirals 3.2 μ in diameter. Diameter of trichomes 0.2-0.5 μ, length 40 μ. Forming small light-green floating masses. Planktonic. Astotin L. July.

S. laxissima G.S. West

Within the mucilage of Cyanophyta. Half Moon L., Hanmore L. May to August.

S. major Kuetzing

Within the mucilage of Cyanophyta. Antler L., Astotin L., Drepanocladus bog north of Stony Plain. June to September.

S. nordstedtii Gomont

Within the mucialge of Cyanophyta. Gull L. May.

S. princeps (West and West) G.S. West

Within the mucilage of Aphanocapsa. Muir L. May.

Borzia trilocularis Cohn

Entangled in other algae in grassy slough five miles north of Spruce Grove. April.

Arthrospira gomontiana Setchell

Within the mucilage of Cyanophyta. Astotin L. Tychoplanktonic in Drepanocladus bog north of Stony Plain. May to September.

A. jenneri (Kuetz.) Stizenberger

In mats of filamentous green algae, plankton enrichment culture from North Saskatchewan River.

Oscillatoria sp.

Trichomes solitary, light green, not tapering at the apices which are rounded. Cells cylindrical, 6 u in diameter and 8 u long, constricted at the cross walls

which appear to be partly disarticulated. No conspicuous vacuoles.
Planktonic. Astotin L. July.

O. acuminata Gomont
Tychoplanktonic. Cooking L.; pool below ski hill, White Mud Park, Edmonton. May and June.

O. acutissima Kufferath
Tychoplanktonic, in mucilage of Cyanophyta. Big Chikakoo L., Muir L., Astotin L. April to July. Soil enrichment culture, Wolford.

O. agardhii Gomont
Planktonic and tychoplanktonic. Lac Ste. Anne, Joseph L. August and September.

O. amphibia C.A. Agardh
In mats of algae in shallow water. Edmonton Beach. August. Holden sewage lagoon.

O. anguina (Bory) Gomont
Soil enrichment culture. University of Alberta campus quadrangle.

O. angusta Koppe
Planktonic and in mucilage of Cyanophyta. Lake Eden, Cold L., Astotin L. May to July.

O. animalis Agardh

On moist soil in shade of trees. Riverbank below University of Alberta campus. May.

O. angustissima West and West

Tychoplanktonic, in mucilage of Cyanophyta. Half Moon L., Astotin L., August and June respectively.

O. chlorina Kuetzing

Tychoplanktonic. Edmonton Beach. September.

O. formosa Bory

On moist soil, waters edge. North Saskatchewan River. September.

O. geminata Meneghini

Planktonic. Lac Ste. Anne, Cooking L., Half Moon L., Edmonton Beach, Allan L. June to August.

O. granulata Gardner

Tychoplanktonic. Gull L. May.

O. limnetica Lemmermann

Planktonic and tychoplanktonic. Lac Ste. Anne; Lake Eden; Half Noon L.; Gull L.; Edmonton Beach; Allan L.; Wabamun L.; Astotin L.; grassy slough, Elk Island Park; White Mud Park, Edmonton; North Saskatchewan River; Holden and Lacombe sewage lagoons.

May to September.

O. limosa (Roth) C.A. Agardh

Entangled among other algae in shallow water. Muir L.; iron-bearing springs, White Mud Park, Edmonton. April to July.

O. nigra Vaucher

Attached to Chara sp. in mucilage of Gloeotrichia pisum. Allan L. September.

O. subbrevis Schmidle

Plankton enrichment culture. Astotin L.

O. tenuis C.A. Agardh

Tychoplanktonic. Muir L.; Astotin L.; barnyard slough near Waskatenau; White Mud Creek, Edmonton. April and May.

O. terebriformis C.A. Agardh

Moist soil, shaded by tree. Riverbank below University of Alberta campus. May.

Phormidium minnesotense (Tilden) Drouet

Tychoplanktonic. Lac Ste. Anne. June.

P. retzii (C.A. Agardh) Gomont

Intermingled with other algae forming green floating films. Grassy slough five miles north of Spruce Grove. July.

Lyngbya aerugineo-caerulea (Kuetz.) Gomont

Soil enrichment cultures, Warburg, Elk Island Park.

Sphagnum moss squeezings, Elk Island Park. September.

L. aestuarii (Mert.) Liebmann

Tychoplanktonic. Lac Ste. Anne, Gull L., Wabamun L.

May and June.

L. diguetii Gomont

Soil enrichment cultures. Warburg, Olds, Rowley.

L. limnetica Lemmermann

Planktonic. Cooking L. July and August.

L. martensiana Meneghini

Tychoplanktonic. Edmonton Beach. June.

L. nordgaardii Wille

Soil enrichment cultures. Airdrie, Stavely.

L. purpurea (Hook and Harvey) Gomont

Tychoplanktonic. Beaverhill L. June.

L. spirulinoides Gomont

Tychoplanktonic. Hasse L. September.

L. taylorii Drouet and Strickland

Tychoplanktonic. White Mud Creek, Edmonton. May.

L. versicolor (Wartmann) Gomont

Soil enrichment culture. Duchess.

Nostocaceae

Anabaena aequalis Borge

Tychoplanktonic. Astotin L. April.

A. affinis Lemmermann

Planktonic and tychoplanktonic. Lake Eden; Astotin L.; grassy slough, Elk Island Park; grassy slough five miles north of Spruce Grove; grassy slough on river flats below the University of Alberta campus; Drepanocladus bog north of Stony Plain; soil enrichment cultures, Warburg, Olds. April to September.

A. augstumalis Schmidle

Soil enrichment culture, Warburg.

A. flos-aquae (Lyngb.) de Brebisson

Planktonic. Cooking L., Lake Mere, Gull L., Muir L., Astotin L., Wildhorse L., Bow River. June to August.

A. helicoidea Bernard

Planktonic. Lake Mere. July and August.

Soil enrichment cultures, Warburg, Olds.

A. planctonica Brunnthaler

Planktonic. Muir L. July.

A. scheremetievi Elenkin

Planktonic. Muir L. August.

A. spiroides Klebahn

Planktonic. Lac Ste. Anne, Big Chikakoo L., Muir L. July and August.

A. spiroides var. crassa Lemmermann

Planktonic. Muir L., Astotin L. June to August.

A. variabilis Kuetzing

Soil enrichment cultures. Olds, Elk Island Park.

A. verrucosa Boye-Peterson

Attached to rocks in swiftly flowing water. White Mud Creek, Edmonton. May.

A. wisconsinense Prescott

Entangled among other algae. Barnyard slough near Waskatenau. April.

Nostoc muscorum C.A. Agardh

Spreading expanse in shallow calcareous pool. Three miles north of Spruce Grove. July.

N. pruniforme C.A. Agardh

Planktonic. Edmonton Beach. June to September.

N. sphaericum Vaucher

In soil at margin of water. Hasse L. September.

N. verrucosum Vaucher

Benthic, in shallow water and washed up on shores. Hasse L., Astotin L., Muir L., July to September.

Aphanizomenon flos-aquae (L.) Ralfs

Planktonic and tychoplanktonic. Cooking L., Iosegen L., Wabamun L., Astotin L., Little Kananaskis L., Moose L., Drepanocladus bog north of Stony Plain, strip mine pits in Coal Valley, Bow River. July to September.

Cylindrospermum stagnale (Kuetz.) Bornet and Flahault

Moist soil in greenhouse pots. University of Alberta.

Rivulariaceae

Gloeotrichia echinulata (J.E. Smith) P. Richter

Planktonic. Pigeon L., Astotin L., Moose L. June to October.

G. natans (Hedwig) Rabenhorst

Washed up on shore. Lac Ste. Anne. August.

G. pisum (C.A. Agardh) Thuret

Attached to stems of aquatic plants. Lac Ste. Anne, Allan L., Lesser Slave L. August to September.

RHODOPHYCEAE

Sub-class Florideae

Thoreaceae

Thorea ramosissima Bory

On Scirpus sp. stems washed up on shore. Lac Ste. Anne. August.

Glossary of Terms Used in the Annotated List

Although this glossary is intended mainly for use with the annotated list, the same terms are used elsewhere.

Enrichment culture- a sample of mud, sand or plankton to which a mineral solution has been added to bring many of the species in the resting state to the vegetative state.

Epiphytic- living upon a plant.

Planktonic- free-living and floating or swimming in deep water.

Slough- a small landlocked body of water, the depth of which does not exceed that at which rooted aquatics grow, and which is temporary, or dries up during prolonged drought.

Tychoplanktonic- free-living or entangled among other algae or vegetation along the shores of lakes or in shallow water.

APPENDIX

UNIDENTIFIED SPECIES

Key to Illustrations

PLATE I

Fig. 1. Uronema sp.

Epiphytic on Cladophora sp. in Astotin Lake. July.
Diameter of cylindrical cells 4.8 μ, length 11 μ.
A single pyrenoid is imbedded in each parietal chloroplast which encircles two thirds or more of the circumference and extends three quarters or more the length of the cells.

Fig. 2. Pediastrum sp.

Planktonic. Lake Eden. June.
A seven-celled coenobium.

Fig. 3. Pediastrum sp.

Tychoplanktonic. Astotin Lake. July.
The cells outlined by dotted lines have matured and released their contents. The vegetative cells are granular and dark green with a single pyrenoid.

PLATE II

Fig. 1. Chaetomorpha linum (O.F. Muell) Kuetz. ?
This may be Rhizoclonium fontanum Kuetz.

a- detail of holdfast.

b- whole filament with escaping akinete.

c- detail of vegetative cell.

d- germling.

Fig. 2. Pediastrum duplex var. clathratum (A.Braun) Lag. ?
The coenobium illustrated is one of many apparently aberrant forms of Pediastrum found in Astotin L.
Cells are a light diffuse green.

PLATE III

Fig. 1. Pediastrum tetras (Ehrenb.) Ralfs ?
Planktonic. Muir Lake. July.

Fig. 2. Scenedesmus sp.
Planktonic. Cooking Lake. July.

Fig. 3. Scenedesmus sp.
Mud enrichment culture. Lake Mere.

Fig. 4. Scenedesmus sp.
Tychoplanktonic. Beaverhill Lake. June.

Fig. 5. Scenedesmus sp.
Planktonic. Joseph Lake. September.

PLATE IV

Fig. 1. Tetradesmus sp.

Planktonic. Astotin Lake. July.

Fig. 2. Cosmarium sp.

Planktonic. Joseph Lake. September.

Fig. 3. Staurastrum sp.

Planktonic. Lake Eden. September.

Fig. 4. Staurastrum sp.

Planktonic. Astotin Lake. July.

Fig. 5. Staurastrum sp.

Planktonic. Muir Lake. July.

PLATE V

Fig. 1. Dinobryon sertularia Ehrenberg

The objects (a) apparently being released may be statospores.

Planktonic. Kananaskis Lake. August.

Fig. 2. Mallomonas sp.

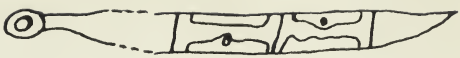


Fig. 1

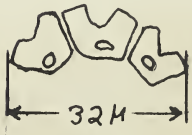


Fig. 2

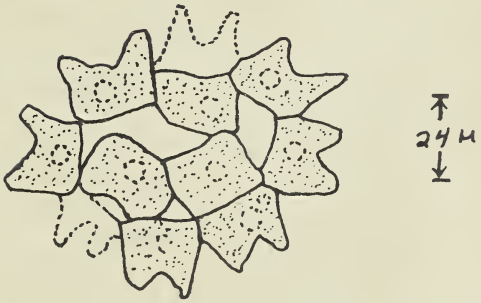


Fig. 3

Plate I.

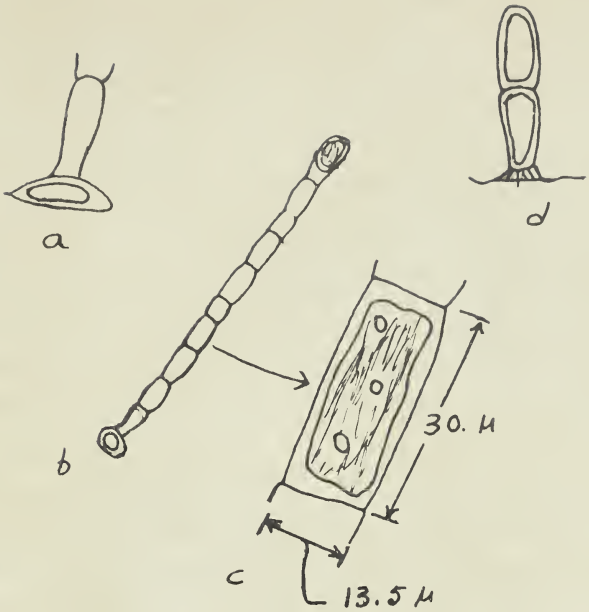


Fig. 1

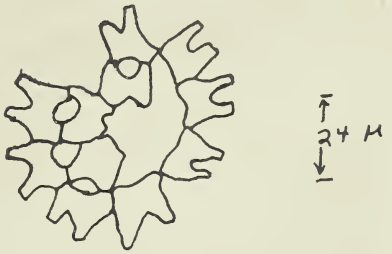


Fig. 2

Plate II.

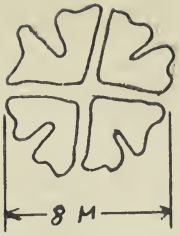
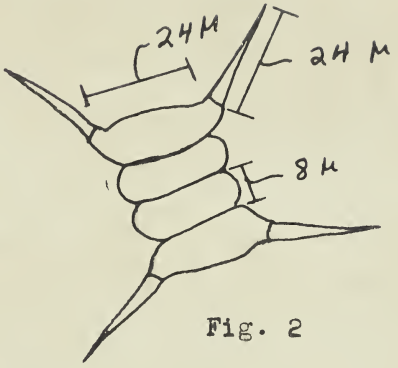


Fig. 1



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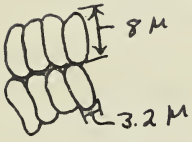


Fig. 3

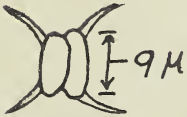


Fig. 4

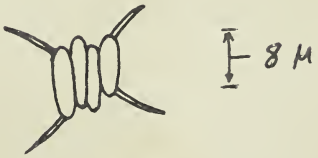


Fig. 5

Plate III

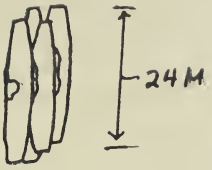
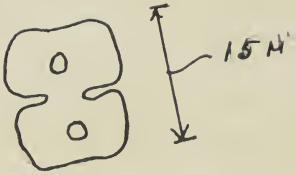


Fig. 1



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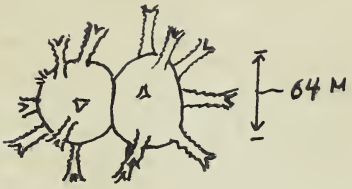

Fig. 3

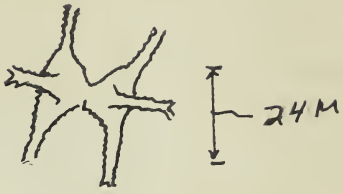

Fig. 4

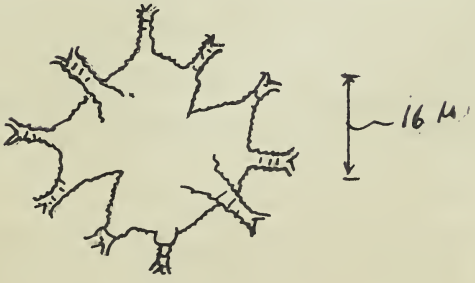

Fig. 5

Plate IV.

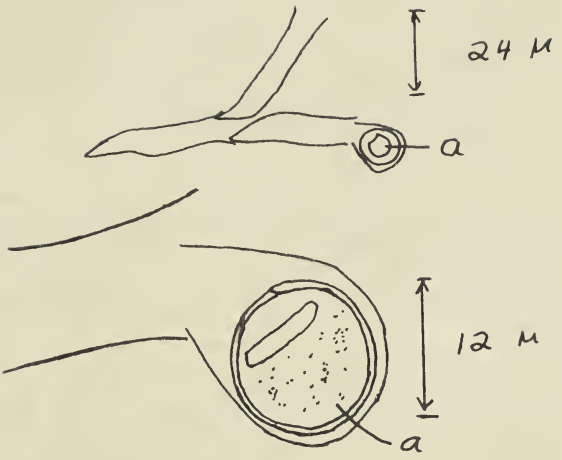

Fig. 1

Fig. 2

Plate V.

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